SENSEGOOD
INSTRUMENTS PVT LTD

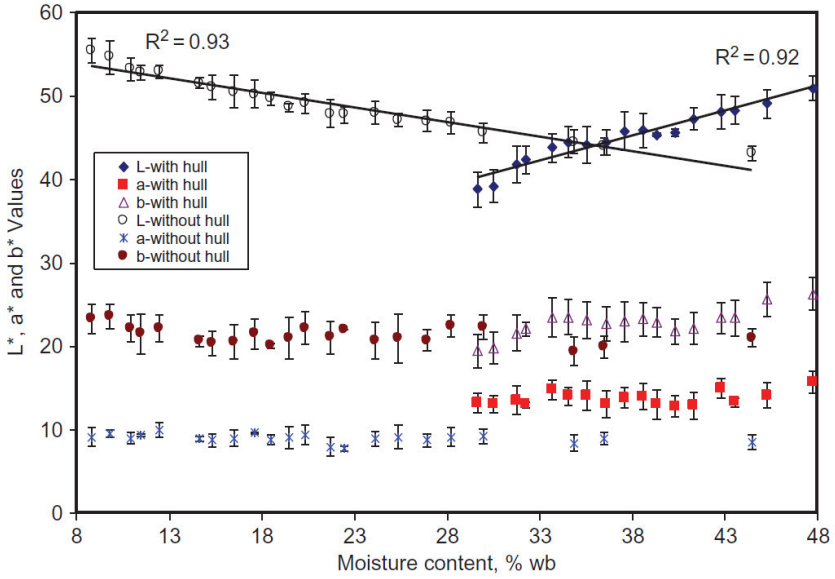
# Sensegood spectrophotometer for color measurement in nuts & dry fruits

Photo: Sensegood spectrophotometer to measure color quality in dry fruits – almond, apricot, betel nut (supaari), cashew, cantaloupe seeds (melon seeds, magajtari), coconut, cudpahnut (charoli), raisin (kishmish), dates (khajoor), dates dried (khaarek), fig (anjeer), ground nuts (peanuts), lotus seeds pop (makhana), pistachio (pista), walnuts, are some of the most commonly consumed dry fruits.

No customer would be ready to pay for off colored dry fruits, thinking it to be of low quality and low in nutrition value. Dry fruit is considered comparatively high priced segment, consumer expects the quality for the price paid. If a product doesn't look as expected, it will never get to be tasted.

Nuts face post processing such as drying for moisture removal. At harvest, the moisture content of individual walnut lot varies significantly due to uneven maturation. These lots with high and low moisture levels are batch dried all together using heated air at about 43$^0$C. Some nuts that enter the dryer with high initial moisture content may end up to moisture content of 10% or higher, which is above the safe storage moisture of 8%. Because of the variability of moisture content among individual walnut lots, it is a common practice that the batch must be over-dried in order to ensure reaching the desired average moisture content and prevent from the quality problem caused by the walnuts with high moisture content. [1] Tests by Thompson and Grant showed that an over-drying to 6% lot average moisture content resulted in 6 to 8 h of additional drying *which represented 25–50% of total drying time. Thus over-drying caused low energy efficiency and revenue losses.* [2]

**Scientific approach to save process cost and increase energy efficiency: Color measurement using Sensegood spectrophotometer for assistance in sorting and drying**:




Graph: Relationship between color indices and moisture content for Howard walnuts with and without hull [1].

Researchers [1] with affiliations including Biological and Agricultural Engineering, University of California – Davis and United States Department of Agriculture (USDA) carried out measurements for three walnut varieties, Tulare, Howard, and Chandler. The results indicated that the L* values are highly correlated with moisture content. The results obtained revealed the potential of using the relationship between color indices of L* and moisture content to sort walnuts before drying, which is essential to avoid over-drying, increase drying capacity, reduce energy use, and obtain high quality walnut products.

To bring down moisture levels and to enhance shelf life, process of drying is considered for all dry fruits and nuts. Sensegood spectrophotometer can assist you in sorting of dry fruit product by measuring L* value. Consider the above graph, L* value for walnut without hull decreases with increase in moisture. Stating in simple terms, lots with higher L* values will have lower moisture content. Hence, such lots should be separated, they require less time duration for drying to achieve desired moisture level of 8%.

**Roasting**:
Apart from drying, nuts are often roasted for color and flavor enhancement. Ensure controlled amount of roasting by establishing color tolerances in Sensegood spectrophotometer. Sensegood spectrophotometer is the versatile device that is engineered to work as handheld/portable, benchtop/table-top or in-process/online color measurement instrument. It helps in picking up even the slightest color difference over the production batches. It helps in finding difference between two colors and shows result in percentage match.

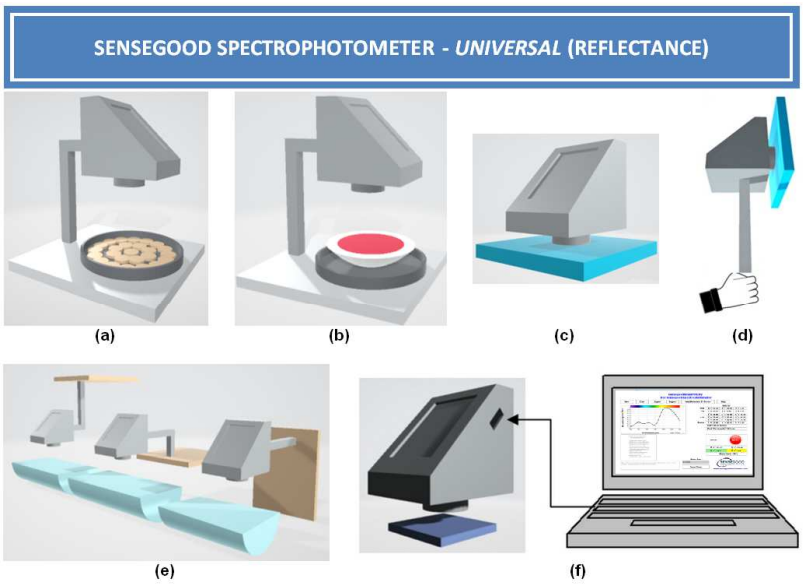

**Sensegood Spectrophotometer for quality and consistency control in roasted almonds and cashews**

Sensegood spectrophotometer measures color difference in dry fruits and displays result in percentage match. If matching is below user set threshold, it warns by providing alarm and indication on LCD. Reference can be saved and recalled anytime to compare it with sample.
Photo: Left – Color difference measurement in roasted almonds (can be any dry fruit though). Color consistency indicates tight process control, resulting consistency in taste and perceived flavor which leads to customer satisfaction and wide market acceptance. Product's consistency is one of the most important parameter that is to be addressed to build and maintain a niche brand value.
Right – Measured color brightness L* and yellowness index in cashews.

Producers, warehouse managers, dried and packaged food (roasted dry fruits) manufacturers and food processors rely on the capabilities of Sensegood spectrophotometer for determining quality and maintaining color consistency over different production batches. Also L*, a*, b* color space values indicate light, redness/greenness and yellowness/blueness; useful in determining quality of white, yellow, green or brown textured dry fruits.

**Instrumental color measurement:**

In the process of visual color match; there are factors like eye fatigue, aging of the eye, stress, individual's different expressive perception toward color, and light source that affect the color match decision. Hence, it becomes difficult to make decision of accepting, reprocessing or rejecting the sample based on visual match. And this directly hampers the quality of the final product. While on other hand there are advantages of instrumental color quality control as it provides results with same accuracy, consistency and reliability.




- ✓ Benchtop/ Tabletop: (a) (b) (Rotating sample platform)
- ✓ Handheld/ Portable: (c) (d)
- ✓ Online/ In-process: (e)

- ✓ Solid: (a) (c) (d) (e)
- ✓ Liquid: (b) (e)
- ✓ Paste: (b) (e)
- ✓ Powder: (a) (b) (e)

- ✓ Contact measurement: (c) (d)
- ✓ Non-contact measurement: (a) (b) (e) (Adjustable height)

Works with:

- ✓ 5V adapter (cell phone charger)
- ✓ Power bank
- ✓ Computer/ Laptop (f)

- ✓ Averaging
- ✓ Auto repeat measurement mode
- ✓ Color match percentage
- ✓ Color indices (whiteness, yellowness, …)

- ✓ *SensegoodSmart* – computer interface software utility

**Sensegood spectrophotometer for color quality and consistency control:**

Sensegood spectrophotometer is an analytical color measurement instrument that is widely accepted in the industry and research fraternity. From raw material to final product, it comprehensively evaluates the color attributes of various samples, including solids, liquids, powders and pastes. Sample can be non homogeneous with different shape and size. Sensegood spectrophotometer has rotating sample platform with large viewing area (sensor's field of view). It takes multiple measurements over number of rotations and generates average result representing the sample's color. As a result, consistency can be maintained and quality standards can be met with less waste, time, and effort.

**Do more with Sensegood spectrophotometer:**

Sensegood spectrophotometer also incorporates continuous auto measurement mode. In this mode, it wakes up at user selectable intervals, takes measurement, compares the sample color with the saved reference, displays percentage match, and alarms to the operator with beeping sound in case if the matching percentage is below preset threshold. It has provision for averaging option in normal mode as well as in auto repeat measurement mode.

Measured color is also represented as reflectance graph, peak wavelength and color temperature on color touch LCD. Sensegood spectrophotometer is non-messy non-contact type instrument which has benefit of measuring sample's color from a distance. Because of this, sensor's optical assembly remains scratch proof enabling long life in retaining calibration. Non-contact measurement avoids any sample contact and contamination on sensor measuring surface.

**SensegoodSmart utility:**

Sensegood provides computer interface software *SensegoodSmart* which lets you to convey numeric color data across all plants and warehouses that may be located it multiple places across the globe. SensegoodSmart utility enables user to store unlimited number of references to the computer. Any desired reference can be recalled and downloaded to Sensegood spectrophotometer whenever required. The utility provides all color

related analytical information on single screen. This feature is even more desirable when using Sensegood spectrophotometer for in-process/online applications.

**References:**

[1] Ragab Khir, Griffiths G. Atungulu, Zhongli Pan, James F. Thompson & Xia Zheng (2014) Moisture-Dependent Color Characteristics of Walnuts, International Journal of Food Properties, 17:4, 877-890, Available at: https://doi.org/10.1080/10942912.2012.675610

[2] Thompson, J.F. and Grant, J.A. 1992. New moisture meter could curb over drying of walnuts, California Agriculture, 46(2): 31–34. https://doi.org/10.3733/ca.v046n02p31

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